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ABSTRACT

A study was designed to measure the relationship between learning to read and learning to write at the elementary school level. Measures of phonics knowledge, reading vocabulary, spelling, reading comprehension, and grammatical and organizational complexity of writing were administered to 256 second grade and 253 fifth grade students. The findings suggested that the reading-writing relationship for children reading below the third grade level is best described as a word recognition-word production (spelling) relationship. For proficient readers, fifth grade level and above, the relationship is more a reading comprehension-prose production relationship. The relationship at this level is based largely on the vocabulary complexity of children's writing. (Author/FL)

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A Canonical Correlational Analysis of Learning to Read and Learning to Write: An Exploratory Analysis

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A CANONICAL CORRELATIONAL ANALYSIS OF LEARNING TO READ AND LEARNING TO WRITE: AN EXPLORATORY ANALYSIS

PURPOSE

The purpose of this study is to measure the relationship of learning to read and learning to write at the elementary school level. This study attempts to identify the nature of specific factors of relationship between these processes as indexed by several, quality instruments; to measure the relative magnitudes of these factors; and to compare and contrast the overlaps across two grade levels (second and fifth) and two reading achievement levels (at or below second grade reading level and at or above fifth grade reading level). It is designed to identify the overlaps that might successfully be manipulated in future experimental studies.

PROBLEM

Evidence suggests that writing has not been accorded much instructional time in American elementary schools (Shanahan, 1979). However, recent emphasis on the "literacy crisis" has led to an overdue re-evaluation of the place of writing instruction in the educational program. Because the total time allotted for school instruction is not apt to be increased appreciably, any increase of emphasis in one area of the curriculum must be made at the expense of the other areas of instruction. An increase in writing instruction could lead to enhanced writing achievement, but because of "curricular specificity" or the tendency of students to learn what is taught, it could also create a decline

in reading or math achievement if the emphasis on them were reduced (Walker & Scheffarzik, 1974). This possibility is especially problematical in the area of reading, because reading and writing are usually perceived to be closely related. It has even been proposed recently that reading instruction could be abandoned and replaced profitably with writing instruction. (Graves, 1978).

The goal should not be simply to increase the amount of writing instruction, but to do so with no appreciable decline in reading achievement, and possibly with an eventual increase in reading achievement. Until the complex nature of the relationships of learning to read and learning to write are delineated, and how these relationships change over time is understood, it is doubtful that reading and writing instruction can be combined with maximum mutual benefit and efficiency (Betts, 1957).

QUESTIONS INVESTIGATED

This study will attempt to answer the following questions:

1. What are the factors of relationship which unite reading and writing development at the second and fifth grade levels?
2. What are the factors of relationship which unite reading and writing development for beginning readers (at and below second grade level) and advanced readers (at or above fifth grade reading level)?
3. Do the factor structures obtained at the second and fifth grade levels differ? If so, in what ways do they differ?
4. Do the factor structures obtained at the beginning and advanced reading levels differ? If so, in what ways do they differ?

METHODOLOGY

Subjects

Twelve second grade and nine fifth grade classes from a desegregated school district located in a Mid-Atlantic state participated in this study. These classes were selected so as to provide heterogeneous samples with respect to sex, race, ethnic background, socioeconomic status and locale. Complete data was obtained for 256 second graders and 253 fifth graders.

Standard scores were computed for all measures and these grade level samples were recombined into achievement level samples on the basis of the grade level equivalency scores obtained on the standardized reading comprehension tests. The beginning reading group included 149 subjects (131 second graders, 18 fifth graders) and the advanced reading group was made up of 185 subjects (154 fifth graders, 31 second graders).

Test Instruments

The measures used in this study were chosen so as (1) to provide maximally valid and reliable measures of those variables identified in previous studies as being correlated across the reading-writing sets; (2) to provide an equivalent measurement of reading and writing at the two grade levels; and (3) to provide the measurement of multiple reading and writing variables.

The following battery of ten reading, writing and spelling tests was administered to all subjects:

a). The Phonetic Analysis Test of the Stanford Diagnostic Reading Tests (S.D.R.T., Harcourt Brace Jovanovich, 1976).

Second graders completed the Red Level of this test designed to measure the ability to relate beginning and ending sounds of consonants, and medial long and short vowels to their most common spelling patterns. Fifth graders completed the Brown Level, designed to assess the subjects's abilities to relate various consonant and vowel sounds to the complex spelling patterns used to represent these sounds.

b). The Reading Comprehension Test of the Gates-MacGinitie Reading Tests (G.M.R.T., Houghton Mifflin 1978) was administered to the second graders and the Reading Comprehension Test from the S.D.R.T. was administered to the fifth graders. These tests require students to answer multiple-choice questions about several short reading passages.

c). The Vocabulary Tests of the S.D.R.T. and G.M.R.T. were administered to the second and fifth graders, respectively. Both tests measure word meaning knowledge through a multiple-choice synonym selection procedure.

d). A "limited cloze test" was designed according to published guidelines (Cunningham & Cunningham, 1978). Students were required to replace words which had been deleted from prose passages taken from out-of-print basal readers. This test served as an alternative method of measuring reading comprehension and context usage.

Two narrative-descriptive writing samples were obtained from each subject. These writing samples were initiated by imaginative line drawings and were written for other children of similar

age levels. These writing samples were combined and analyzed for (e) grammatical complexity (mean t-unit length); (f) vocabulary diversity (the number of different words used in the combined writing samples); and (g) organizational structure (the number of organizational structures or categories used according to Stein's story grammar (1978)).

h). An experimentor-designed spelling test was administered to all subjects. These 25-item tests were made up of words selected on the basis of their frequency of usage in the writing of students at these levels (Rinsland, 1945; Hillerich, 1978), and their relative spelling difficulty (Greene, 1954). These spelling performances were then analyzed for (i) phonemic accuracy (the number of phonemes represented in an orthographically acceptable manner with no regard to positional constraints) and (j) visual accuracy (a qualitative analysis of the degree to which the misspellings look like standard spellings).

Data Collection

The author administered and scored all tests with the assistance of paid, trained assistants. All tests were group administered over a five week period in February and March, 1980.

Data Analysis

Pearson product-moment correlations were calculated for all tests for each grade level and achievement level cohort. These intercorrelation matrices were then analyzed through the use of the Canonical Correlational Analysis procedures available through the Coolons statistical package (Cooley & Lohnes, 1971). Bart-

lett's chi-square procedure was used to test the statistical significance of the canonical factors, and redundancy coefficients were calculated to measure the meaningfulness of the factors in terms of proportions of variance explained in the reading and writing sets.

RESULTS

Second Grade Level

The canonical analysis of the second grade matrix resulted in the extraction of four canonical factors (Table I). However, one of these factors failed to achieve an acceptable level of statistical significance ($p<.05$). Although the R_c's appear to be sizeable, the redundancies and percentages of variance extracted from each set indicate that only the first factor is meaningful. This factor extracts 53% of the writing variance (redundancy= .33) and 65% of the reading variance (redundancy= .41).

Table I. Canonical correlations, eigenvalues, Wilks lambdas, and chi-square tests for second grade analysis of six writing tests and four reading tests.

FACTOR	R_c	Eigenvalues	Lambdas	Chi-Square	d.f.	Significance
1	.79	.619	.29	307.31	24	p<.001
2	.42	.179	.77	65.38	15	p<.001
3	.23	.054	.94	15.99	8	p<.05
4	.09	.008	.99	2.00	3	N.S.

The factor structure coefficients or factor-variable correlations for the first canonical factor are reported in Table II. This factor loads heavily on all reading and spelling measures. The factor appears to be a general reading achievement-spelling achievement factor despite only moderate intercorrelations among the original reading variables, and limited achievement variance available in the Phonics Achievement Test.

Table II.* Structure coefficients for the first canonical factors from the second grade, fifth grade, beginning reader, and advanced reader analyses.

	Second Grade Factor I	Fifth Grade Factor I	Beginning Reader Factor I	Advanced Reader Factor I
Writing Set				
Vocabulary Diversity	.64	.57	.56	.61
Avg. t-unit Length	.40	.25	.24	.01
Story Structures	.63	.51	.40	.48
Spelling	.94	.93	.84	.82
Phonemic Accuracy (Spelling)	.75	.48	.87	.66
Visual Accuracy	-.87	-.89	-.93	-.60
Reading Set				
Phonics	.86	.82	.88	.61
Comprehension	.82	.81	.60	.66
Cloze Test	.87	.83	.72	.76
Vocabulary	.67	.89	.59	.66

*Because of differing amounts of variance, factor structures can be compared across grade levels or achievement levels, but not from grade levels across to achievement levels.

Fifth Grade Level

The canonical analysis of the fifth grade data also resulted in four orthogonal canonical factors (Table III). Again, only one factor was significant and meaningful in terms of variance accounted for in the reading and writing sets. This factor accounts for 42% of the writing variance (redundancy= .25) and 70% of the reading variance (redundancy= .41). As with the second grade data, the canonical factor loads at a consistently high level on all reading variables (Table II). The spelling variables also contribute heavily to this factor, but this spelling contribution is visual, and not phonemic, in nature.

Table III. Canonical correlations, eigenvalues, Wilks lambdas, and chi-square tests for fifth grade analysis of six writing tests and four reading tests.

FACTOR	R_c	Eigenvalues	Lambdas	Chi-Square	d.f.	Significance
1	.76	.582	.39	233.66	24	$p<.001$
2	.21	.045	.93	17.64	15	N.S.
3	.14	.019	.98	6.27	8	N.S.
4	.08	.006	.99	1.50	3	N.S.

Beginning Reader Sample

Two significant canonical factors were extracted from the beginning reader data (Table IV), but only the first factor

had a redundancy statistic high enough to warrant further analysis. This factor explained 31% of the writing achievement and 32% of the reading achievement. An examination of the factor loadings (Table II) reveals a sizeable phonics analysis test contribution on the reading side, and the spelling variables continue to load heavily on the writing side. Thus, this is a word recognition-word production factor.

Table IV. Canonical correlations, eigenvalues, Wilks lambdas, and chi-square tests for second grade reading level sample (n=149).

FACTOR	R_c	Eigenvalues	Lambdas	Chi-Square	d.f.	Significance
1	.81	.650	.28	179.89	24	p<.001
2	.42	.179	.80	31.76	15	p<.01
3	.15	.022	.97	3.89	8	N.S.
4	.07	.005	.99	.75	3	N.S.

Advanced Reader Sample

Three significant canonical factors were extracted from the advanced reader sample data (Table V). The constraints on variance caused by the sampling procedure, however, had devastating effects at the fifth grade level. This factor explained only 16% of the writing variance and 21% of the reading variance. When reading comprehension variance is held constant, as it was in this procedure, the reading-writing relationship loses its

power of explanation at advanced reading levels (of course the same procedure had no such effect at the beginning reader level, indicating the importance of comprehension to the reading-writing relationship at advanced levels). Even with controls on comprehension, the contribution of the cloze variable and the vocabulary diversity and organizational structure variables increase and the word recognition-word production variables decrease in importance (Table II).

Table V. Canonical correlations, eigenvalues, Wilks lambdas, and chi-square tests for fifth grade reading level sample (n=185).

FACTOR	R_c	Eigenvalues	Lambdas	Chi-Square	d.f.	Significance
1	.67	.449	.43	150.56	24	p<.001
2	.38	.142	.78	44.20	15	p<.001
3	.27	.071	.91	26.94	8	p<.05
4	.14	.021	.98	3.78	3	N.S.

CONCLUSIONS

The following conclusions seem warranted on the basis of these findings:

1. Learning to read and learning to write are significantly related at the second grade level and at the fifth grade level. They are also significantly related at both

beginning and advanced reading levels.

2. The reading-writing relationship at the second grade level is best described as a general reading achievement-spelling achievement factor. A similar factor was apparent from the fifth grade analysis, although the spelling contribution was more visual than phonemic in nature.
3. The reading-writing relationship for beginning readers is best characterized as a word recognition-word production factor, while at the advanced reading levels it is a prose comprehension-prose production relationship. The vocabulary diversity and organizational structure variables from the writing set contribute maximally to this prose factor. The sampling procedure artificially limited variance available in the standardized reading comprehension test. This limitation did not curtail the magnitude of the reading-writing relationship at the beginning levels, but it was devastating for advanced readers. The profound effect of comprehension test controls on the relationship indicates the importance of comprehension to the relationship at this level of development.

IMPLICATIONS

The findings of this study suggest that, although they are related, reading and writing each entail the learning of unique skills, or that similar skills develop in different sequences. The relationships of learning to read and learning to write

account for less than half of the variance in reading and writing achievement. The combination of those aspects of reading and writing which are, at best, weakly related would probably not stimulate greater achievement or provide greater instructional efficiency. Although the suggestion that writing instruction could simply replace reading instruction (Graves, 1978) is appealing in its simplicity, the results of this study indicate the need to teach reading and writing. Some instructional combination of reading and writing probably could be beneficial, but simple replacement would probably have deleterious effects.

Because this study is an exploratory investigation only, which used a correlational design, it is impossible to infer that specific combinations of reading and writing would have mutually beneficial outcomes. Specific curricular reforms must be critically examined through experimental study. Nevertheless, this investigation suggests parameters within which such curricular studies might proceed and specific hypotheses which might be profitably tested. (The exploratory nature of this study must be stressed as it is the first study to employ multivariate techniques to analyze this relationship, as well as the first to examine how such relationships change with learning and development).

An important finding was that the nature of the reading-writing relationship changes over time. It appears possible that spelling activities will have a beneficial influence upon the word recognition skills of beginning readers, but as learning

to read progresses the impact probably declines. At these more advanced levels, the impact of writing does not disappear. It only changes. The experiences of utilizing complex vocabulary in composition and the structuring of ideas through writing seem to provide new avenues to reading achievement. Future studies need to examine the impact of invented spelling (Zutell, 1978), word sorts (Gillet & Temple, 1978), and writing from word lists (Mason, McDaniel, & Callaway, 1974) upon the word recognition skills of beginning readers. Other studies are needed to examine the influence of story makers (Rubin, 1980), and various types of modelling (Stewig, 1975; Cramer & Cramer, 1975) and rewriting activities (Martin & Brogan, 1972) upon the reading comprehension of more proficient readers. Because these changes in the relationship of learning to read and learning to write occur in close conjunction with reading development, it might be possible to insert any experimentally validated procedures which combine reading and writing instruction directly into existing reading programs.

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